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Service Grids: The Missing Layer in Web Services

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PC Forum, March 23-25, 2003. Sign up before the early registration deadline, January 10.

BY JOHN HAGEL AND JOHN SEELY BROWN

Amidst all the excitement over Web services, people sometimes expect miracles: applications interacting peer-to-peer without a common language, without knowledge of one another, and without quality issues or disputes. Because Web services and peer-to-peer are so ideologically driven, anything that smacks of IT or central policy-setting signals impurity. . .

But reality is different: We aren't usually aware of all that a cio or a company's technical infrastructure does, and so we may not realize what will be needed for Web services to function smoothly. Precisely because they are intended to operate beyond corporate walls, they need something to replace not just the technical integration functions performed by MIS, but also something to allocate resources, set priorities, warrant reliability and resolve disputes. Any set of interacting services needs to be coordinated, if not controlled, and it needs to follow policies set and enforced. . .perhaps not centrally, but globally.

This article is about that set of coordinating, virtually equidistant services that perform the infrastructure functions applications expect from their environment, whether it's an internal IT infrastructure or a distributed Web services environment. It's a market waiting to happen.

Guest co-writers John Hagel and John Seely Brown call it the service grid – a nice term that avoids any connotation of either centralization or hierarchy, and that sounds supportive rather than directive. They are talking about technical functions, such as metering or allocating usage or translating from one technical platform to another, and also business/policy services, such as reputation services, dispute resolution and resource allocation (pricing).

{ *continued on page 2* }

Few people are better qualified to write about this topic than Hagel and Brown, who combine a deep understanding of business needs and technology requirements. Both have worked together in the Web services arena over the past two years, trying to understand the experiences of early adopters of the technology. They shared the excitement many people felt over Web services, but quickly realized that there was no magic to be had. Cios to some extent could breathe a sigh of relief. Though the structure of cio's activities might change, the need for coordination, planning, project design, architecture and the like has not disappeared. While it may not be necessary to predefine how everything works, we still need cios and the like to set policies and define risk levels. The parts may interact more smoothly, but someone still needs to design the pieces and develop the rules for them to interact by. Part of Hagel's and Brown's task going forward will be to explain to cios how to manage in this less deterministic, more interdependent environment.

Hagel has spent over 20 years, including 16 with McKinsey, exploring the intersection of business and information technology. He works with a broad range of companies to develop innovative business strategies and generate more value from IT investments. He is the author of the recently published Out of the Box*, as well as the business best-sellers* Net Gain *and* Net Worth.

John Seely Brown was the director of Xerox PARC for many years and also was Xerox's chief scientist. He is the co-author, with Paul Duguid, of The Social Life of Information *and the October 1995 issue of Release 1.0, on "The Social Life of Documents." He serves on the technical advisory board of Warburg Pincus and on the board of directors of Systinet, a WP-funded Web services start-up [DISCLOSURE: ESTHER DYSON IS AN INVESTOR AND DIRECTOR], as well as of several public companies. He continues to write and speak on Web services, innovation and organizational learning.* — *Esther Dyson*

Momentum is starting to build behind Web services technology deployments. To date, these deployments have been relatively modest from a technology perspective: generally simple synchronous XML-SOAP- remote procedure call request/reply or asynchronous messaging to receive, exchange and aggregate data across applica-

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tions. Contrary to conventional wisdom, many of these early deployments extend across firewalls to connect applications residing in multiple enterprises. As businesses start to reap significant operating cost and asset savings from these early deployments, executives are becoming more interested in broader deployments of the technology to coordinate business processes and support mission-critical transactions.

It's easy to do a Web services demo; it's difficult to scale it up in any kind of real operating environment, particularly in terms of providing mission-critical functionality such as security, reliability and high performance. Without the emergence and evolution of robust services to support these core business activities, Web services technology will remain marginalized and its business potential unrealized. The concept discussed in this issue, what we have termed "service grids," provide the infrastructure and technology that will allow Web services to scale up. Merrill Lynch cto John McKinley agrees: "The service grid concept helps provide a much-needed holistic view of what the commercial market needs to address as we move forward." While the attention of technology vendors and pundits remains focused on two other layers of the Web services architecture – the foundation standards and protocols, and the application services ultimately enabled by these standards and protocols – service grids are the critical missing layer.

What Are Service Grids?

Service grids support and enable Web services applications with functionality such as service definition and discovery, security and access control, metering/billing, routing of messages across applications or data transformation between applications. This functionality is analogous to middleware for enterprise applications, only in this case it is delivered as a set of managed services rather than as installed software. Service grids handle legal and corporate as well as technical boundaries between components.

In short, service grids provide a framework for assembling and delivering the enabling services required to support robust connections across applications using Web services standards.[1] Kevin Werbach observed (SEE **RELEASE 1.0**, NOVEMBER 2002)

[1] Service grids should not be confused with grid computing, a concept currently garnering attention in the technology world. Grid computing (or virtualization) emerged as a way to help users more effectively share computing resources. (Over time, some grid computing initiatives have adopted distributed services architectures and are leveraging Web services technology to help design and operate these architectures, but that simply reflects the increasing interconnection of the computer ecosystem.)

that "grid software is a new kind of middleware – middleware that makes devices, and pools of devices, manageable as single entities." Service grids represent a different kind of middleware – middleware that coordinates activities across functions to create seamless-looking applications (rather than across devices to create a seamless-looking computing resource).

While there are no pure service grids in place yet, there are emergent service grids that appear on promising trajectories. In realizing this vision of decentralized services replacing the local, single-source control of a single IT operation and its cio (and subordinate vendors), service grids face a challenging "chicken and egg" problem. Unless there are many utilities available, service grids are simply single vendor platforms rather than interacting services. Users have little choice but to implement the functionality internally or buy it from a single source. Conversely, unless there are many service grids willing to source functionality from specialized third parties, there will be little incentive for these utilities to emerge. In this issue, we identify some candidates to provide service grid utilities, aggregate these services or integrate these services – mostly single third-party service providers with good prospects.

Standards, protocols, applications. . .and the missing layer

The emergence of service grids needs to be understood from two perspectives: technology architecture and business ecology. Let's start with the architectural view. The foundation level of Web services technology is standards and protocols, with XML as the standard format for exchanging data. This foundation standard in turn has spawned a whole series of derivative standards and protocols that enable the exchange of application functionality, including Simple Object Access Protocol (SOAP, a common format for addressing messages), Web Services Description Language (WSDL, a standard way of describing the functionality of a Web service and instructions on how to access it) and Universal Description, Discovery and Integration (UDDI, a uniform way of registering Web services so they can be searched for and discovered by others). These standards and protocols are essential building blocks for Web services technology.

Technologists then usually skip up to the application level, painting futuristic visions of enterprises using Web services standards to dynamically compose new applications to address specific needs of the business at any point in time. Generally, these visions suggest that many micro-services will be knit together to create broader application services tailored to specific enterprises or even specific transactions.

Occasionally one might hear about a broker helping to compose these applications, but most discussion remains tightly focused on the providers and users of application services. Even after several years of hype for the technology, very few people seem to "get" the importance of service grids, much less champion them aggressively.

It's all the fault of P2P: Not by ideology alone

In part, the close relationship in the eyes of many technologists between Web services technology and peer-to-peer architectures explains this bias. In a world where all forms of hierarchy are suspect, the P2P vision of decentralization is seductive and profoundly liberating.

Yet if we look closely at real-world implementations of P2P architectures, we find they are not quite so pure as they at first might seem. Napster (SEE **RELEASE 1.0**, NOVEMBER-DECEMBER 2000) used a central server as a registry for its music resources. Groove (SEE **RELEASE 1.0**, NOVEMBER 2000, FEBRUARY 2002), another popular example of a peer-to-peer application/environment, uses a message-queuing server independent of the nodes to ensure reliability of message delivery. The purity of peer-to-peer dissolves in the face of pragmatic business needs. One must either sacrifice functionality or accept much higher complexity at the nodes.

The same is true of Web services. Many of the most fervent champions of Web services technology keep falling back on relatively simple application examples, such as a currency converter or delivery of stock quotes to a cell phone. In these examples, robustness of connection is not a big concern. But consider a real-world securities-trading application in which making a trade is delayed by a few seconds. Latency can mean the difference between a profit and a loss.

Perhaps there is more of a role for hybrid peer-to-peer models, where the end-points would retain the ability to connect with each other as peers, but they could also access specialized (and optional) services designed to make connections more direct and robust. Service grids play this latter role in distributed services architectures.

It is important to note that service grids do not imply a return to the feature-heavy, "smart" networks of the voice telecom world. They honor the value of simple, "dumb" networks while also honoring the need of participants for higher levels of enabling functionality. They operate as optional overlays on existing networks: Providers and users of Web services can choose whether to use the enabling functionality offered by service grids. In this way, a distributed service architecture pre-

serves both the simplicity and ubiquity of the underlying Internet platform, but offers participants additional enabling functionality for those who want it.

From seedling to ecosystem

Service grids are not just a technical construct; they represent an emerging business ecology as well. As distributed service technology architecture becomes more pervasive, a rich mixture of services – some developed internally by companies and others offered by specialized third parties – will come together to create a robust market, shaped by federations of providers. Some of the service grid's structure will emerge, as in a market, but some will be defined by the players – whether by vendors delivering seamless application services or by customers assembling such applications for themselves.

These services will be *managed* services: Their value will hinge on specialized businesses defining the processes and policies required to effectively deliver and operate this functionality on behalf of customers. Even more broadly, these services comprise people and corporate and legal structures as well as technical services. They perform financial and legal transactions as well as database updates.

Some distributed Web services functions simply require the collective action and accountability afforded by the service grid to ensure that individual actors play their roles appropriately. The grid represents the "market" or an ecology rather than the individual players. At the technical services level, ecology refers to the emergence of a diverse set of enabling services (for example, granular encryption services) that can be knit together to create tailored service grids (offering broad-based security infrastructure services, for example) for particular business environments. At the business level, ecology refers to the emergence of a diverse set of business types (utilities, aggregators and integrators) that will federate and develop governance mechanisms required to deliver and operate managed services on behalf of customers.

The technological architecture and business ecologies of service grids will emerge organically, with functionality evolving in response to the needs of specific companies or groups of companies. This bottom-up approach to supporting business communities stands in sharp contrast to the first wave of top-down B2B services that responded primarily to the perceived needs of investors.

Grids save the day

Service grids will be loosely coupled federations of disparate services tailored to the needs of specific application environments. In fact, service grids are likely to be federated with each other, in much the same way that electrical power grids are federated to provide access to a broader range of production capacity. Operating orthogonally to the applications, they create the connections required to support connections at the application level (creating a meta-meta level of connection, if you will).

Of course, the level of integration for a particular Web service application will depend on the performance needs of the processes being supported. For certain kinds of trading settlements, millisecond response times and a high degree of predictability may impose performance constraints beyond the capabilities of a federated approach. Federation also raises concerns about trustworthiness. The more loosely coupled or broadly extended the components of an application, the more important are the quality-control and -assurance features of the service grid.

This is why the concept of managed services is key to the service grid. On even the most basic level, the concept of non-repudiable messaging, so critical to the performance of mission-critical business processes, calls for the presence of an impartial, third party. Take the example of WSDL, the standard by which providers can represent what their Web services can do. Who will verify those representations? Who will provide a third-party auditing function to monitor the performance of the Web service and confirm that it performs as represented, or will resolve disputes? Who will manage metering, billing and payment once many of these services go commercial? For WSDL and UDDI to provide trusted services, some third-party service will be required to administer independent, impartial reputation systems. These systems could operate on a turbo-charged eBay-style model where users can indicate whether a Web service performs as represented. The reputation systems might also include dispute-resolution and certification services like the one operated by SquareTrade with rigorous approval and compliance processes (SEE **RELEASE 1.0**, OCTOBER 2000 AND MARCH 2001); they will likely also include specialized performance and compliance auditing services.

Or, take the case of security standards. Standards are important, but what matters even more is the ability to compare and align security policies among the participants in a business process. Some kind of managed service would be required to perform this function, as well as to deal with the inevitable exceptions that the automatic rules can't handle. Also, you need a shared identity-management infrastructure and the ability to pass identities and authentication assertions across dis-

parate identity management infrastructures – cf. Passport or the Liberty Alliance standards (SEE **RELEASE 1.0**, JUNE 2002).

Within the enterprise, such enabling services may be purchased from a single vendor or developed and administered by the IT department. But when Web services are provided and used across multiple enterprises, service grids can perform many of the same functions as a cio performs within the enterprise; e.g., defining and enforcing policies and priorities, resolving exceptions when they arise and refining policies accordingly, delivering services to support applications, and recruiting and supplying appropriate technical expertise.

By concentrating exception-handling activity and the development of new routines, service grids accelerate learning and refinement of the underlying services. Service grids also foster and convene communities of participants so they can concentrate on addressing current business needs and anticipate the next wave of business needs. These communities coalesce around mechanisms to engage instantly appropriate stakeholders from all parties concerned to handle an exception (with its complete context captured for inspection). By capturing the context and resolution of each breakdown, service grids can help specific groups of business partners to extend the current rules and terms of engagement in a context-sensitive manner, and generate new policies to handle the former exceptions routinely. Service grids can be more effective in doing this because they can act as neutral parties to mediate among all the participants and because they provide the mechanisms for the aggregation of appropriate operational information and for collaboration.

Utilities: Building Blocks of the Service Grid

Service grid utilities are functional; they either solve a business need, such as billing or reputation management, or a technical need, such as message queuing or data transformation, in order to enable seamless Web service applications.

These utilities will likely at first come from companies with specialized capabilities essential to service grids. Using Web services technology, the companies can "expose" their functionality and partner with emerging service grid aggregators such as Grand Central (PAGE 22) and Commerce One (PAGE 10) to offer their services as part of a broader service grid offering.

This ability to bootstrap existing technologies is a key feature of service grids. Large-scale, proven technology can be made more broadly available without having to be re-engineered, except at the interfaces. As mention above, if users had to wait for a whole new set of enabling services to be developed from the ground up, the adoption process would lengthen considerably.

Service grid utilities provide four broad categories of managed services (SEE FIGURE 1):

- **Shared utilities** provide services that support not only the application services but also the other utilities within the service grid. There are four initial types of shared utilities. Security utilities provide identity-management-based services such as authentication, authorization, and accounting. Performance auditing and assessment utilities provide assurance to users that they will obtain agreed-upon levels of performance and will be compensated for damages if performance falls below these levels. Specialized bonding/warranting services and arbitration services will help to reduce and manage risk for both providers and users of Web services. Billing and payment utilities allocate and aggregate usage charges and ensure prompt and full payment.

- **Transport management utilities** include messaging services to facilitate reliable and flexible communication among application services as well as orchestration utilities that help companies assemble sets of application services from different

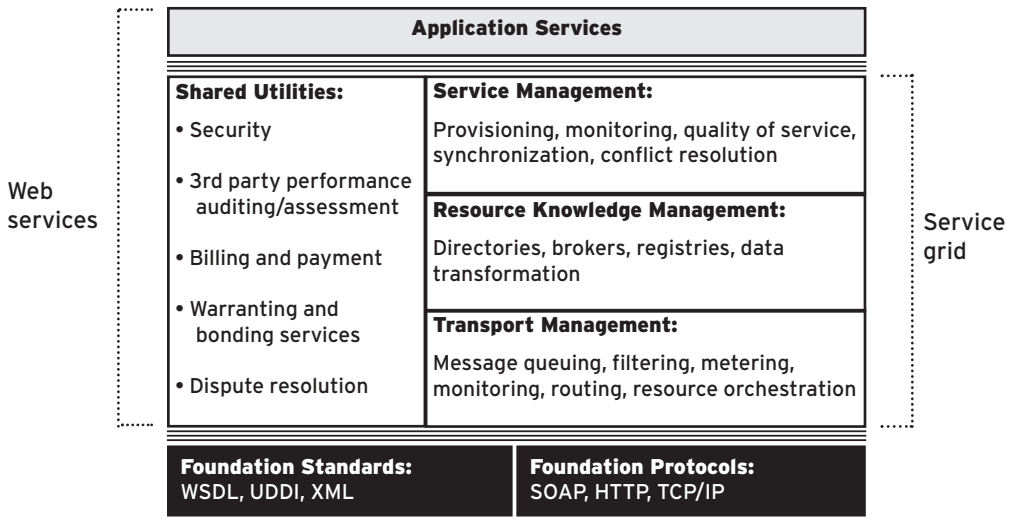

FIGURE 1: *Service grids: the critical missing layer in Web services*

providers. These utilities will also provide certain metering services required to support billing.

- **Resource and knowledge management utilities** include messaging services to facilitate reliable and flexible communication among application services as well as orchestration utilities that help companies assemble sets of application services from different include Web services (UDDI) directories, brokers, and common registries that describe available application services, terms and conditions, and the correct ways of interacting with them. Reputation management services will help users assess capability and understand performance in many different environments. Specialized services will transform data from one format to another. Other utilities in this category, many of them domain-specific, will also help to develop and refine the XML schemas and UDDI taxonomies required to ensure shared meaning among participants.

- **Service management utilities** ensure reliable provisioning of Web services. They also manage sessions and monitor performance to ascertain conformance to quality-of-service specifications and service-level agreements (SLAs). In this context, they would also provide information required to support billing.

Grids in Action

As we said earlier, the first service grids will come mostly from single suppliers, companies that already have a developed a competency that can be translated into the provision of a service grid utility (in this section) or aggregation or integration services (see chart on the facing page) .

A prime example of this trend is Citibank, which has long been an innovative user of technology. It recently developed an extension of its core electronic payment-processing platform, using Web services to expose this functionality and to automate connections with (existing) customers seeking to use it. Electronic marketplace service providers such as Commerce One have become key customers, embedding the Citibank service in their broader service platform. XML messages provide the "glue" connecting the functionality of market-exchange platforms such as Commerce One's Global Trading Web with the Citibank application and Citibank's Global Settlement Network, consisting of a variety of specialized automated clearinghouse (ACH) networks. In effect, Citibank has created a key application service to support broader electronic commerce application services.

An enterprise using Commerce One's Global Trading Web can pre-register information about authorization levels for specific employees and corporate bank accounts to be used for payment on purchases. When a purchase is made, the purchaser clicks the Citibank icon. At this point, the application assembles an XML-based message containing payment instructions, including the amount involved, the identity of the purchaser, the identity of the supplier, the bank that funds are to be drawn from, and the bank that the funds are to be transferred to, along with details regarding the timing of the payment. Citibank then routes the message, according to pre-defined rules, to the appropriate specialized settlement networks. This significantly increases convenience for the purchaser by knitting together a variety of preexisting applications using Web services standards and protocols.

The benefits for both buyers and sellers are compelling – sellers reduce the time required for settlement by 20 to 40 percent, and both buyers and sellers reduce their settlement costs by 50 to 60 percent. Citibank benefits by building existing operational capability into a new service line, which reaches a broader range of customers through platforms such as Commerce One. Commerce One also benefits. By providing the users of its Global Trading Web access to value-added services from highly

	Type of company	Examples
Utilities	Specialized software companies	VeriSign, Contivo, MagnetPoint
	Large enterprises with specialized service capabilities	Citibank
Aggregators	First generation B2B entrepreneurial companies	E2open, Comergent, Talaris, Commerce One
	Industry collaboration hubs	Sabre and SWIFT
	Telecom service providers	British Telecom
	Large enterprises with specialized service capabilities	General Motors/OnStar
	Focused entrepreneurial startups	Grand Central, Flamenco Networks
	Web services management companies	Actional, AmberPoint, Talking Blocks
	Enterprise Application Integration (EAI) vendors	TIBCO
Integrators	Traditional systems integrators	IBM Global Services
	Next generation systems integrators	NerveWire

FIGURE 2: *Candidates for the service grid*

credible providers like Citibank, Commerce One eliminates the need to develop or provide these services itself and can focus on its core business.

At this stage, the Citibank service is more of an application service, helping e-commerce participants to pay for goods purchased in electronic markets. However, the same payment-processing capability could be delivered as a broader enabling service within a service grid to help providers of Web services receive payment for the use of their Web services. Citibank recognizes the opportunity to take its specialized capabilities and expertise and make it available as a service grid utility, reaching customers through other customers and without having to market to them. As Denise McLaughlin, vp of Citibank e-Business, observes, "Our objective is to be the leading e-business enabler, to support our customers as they move their services to the Web. By exposing our capabilities [as part of a service grid], we expand the distribution of our capability which, in turn, expands our revenue opportunities."

VeriSign-up for security

Other, more focused technology companies can also play a growing role in providing specialized enabling utilities. Take VeriSign, a company that issues SSL certificates, delivers Public Key Infrastructure (PKI) services and offers access management services to enhance the security of Web connections. VeriSign developed this business before the emergence of Web services technology, but recognizes that this capability is especially critical in a distributed services architecture. "For enterprises to realize the true potential of Web Services, the industry will need to aggressively address two issues: trust and interoperability," says Stratton Sclavos, ceo of VeriSign. "There must be a common framework, or service grid, for embedding trust and interoperability into the major platforms." It can draw upon its well-established reputation in this field and large installed base to serve this new market.

Early in 2002, VeriSign announced a series of deals with the major Web services technology vendors – IBM, Microsoft, Sun, BEA and Oracle – to add its security and authentication technologies to their Web services platforms. Later in the year, VeriSign and IBM announced an Access Management Service (AMS) to offer the first fully managed service for Web services access control and authorization. Combining the capabilities of IBM's Tivoli Access Manager with VeriSign's authentication, PKI infrastructure and validation services, AMS offers a rich array of security functionality and represents an interesting early example of a specialized enabling service utility. It can be offered directly to businesses exposing application functionality as a

Web service or it can be delivered through service grid aggregators and integrators as part of a broader service grid offering.

Dialectical deciphering of dialects

While XML establishes a common format, or grammar, to support communication across enterprises, grammar alone is not a foundation for communication. Nouns and verbs must have meanings shared among all participants. An XML tag may be helpful in designating where product size information is presented, but do all parties agree on the meaning of product size? Is size represented in inches or centimeters? Does it list height before length and width, or vice versa? Developing standardized meaning around business process terms is even more difficult. What are standardized ways for communicating shipping status or for changing shipping instructions? Without agreement on specific terms, serious misunderstandings can occur.

Contivo hopes to solve this problem. It is a specialist in designing data transformations, a key service that will be required to automate connections across applications and enterprises. Says cto Dave Hollander, "Many people have underestimated the problem of semantics in Web services: No matter how hard we push to standardize vocabulary, there will always be variations that must be dealt with quickly and effectively."

CONTIVO INFO

Headquarters: Mountain View, CA
Founded: June 1998
Employees: 55
Funding: $28 million from Bank of America, MSD Capital, Voyager Capital, BEA, TIBCO, webMethods.
URL: www.contivo.com

Contivo's Enterprise Integration Modeling server provides an integration metadata repository, offering a centralized resource of metadata models to describe both the format and the meaning of application data and structured business documents.

It is also one of the few companies that truly recognizes the value of a service grid in delivering its services to its clients. "We see a significant opportunity in supporting the formation of open service grids to help connect appropriate users to our capability," says Hollander. Emerging service aggregators Grand Central and Commerce One have both signed on Contivo as a business partner to deliver its service as part of their broader platforms.

In some cases, specialized organizations have emerged to help facilitate the development of shared meaning. Often these are industry consortia that have invested years of effort to build shared meaning on industry-wide business process terminology through exception-handling. As Mark Resch, former ceo of CommerceNet (an early

and active sponsor of the RosettaNet initiative, below) and current ceo of Onomy Labs, observes, "The vendor hubris of the 90's that encouraged companies to modify their business relationships and processes to match technology has given way to collaborative construction of evolving systems – service grids – that increasingly match actual business processes."

Because each industry has different vocabulary and practices, a broad range of initiatives have emerged in specific industries like financial services, consumer goods, automotive and construction. Such efforts could be significantly broadened and accelerated through the availability of specialized utilities that help create, disseminate and refine shared meanings as misunderstandings and exceptions arise, indicating where shared meaning does not yet exist.

Industry consortia like RosettaNet, a non-profit organization bringing together 400 companies in the electronics industry, provide early examples of shared meaning utilities. Opportunity exists for more commercial entities to offer this service as well. For example, CNet Channel has built a successful business in helping computer industry players develop standardized ways of representing their products. CNet Channel has defined and built a granular and highly structured database of product information called Transactive Product Data. This database of more than one million SKUs of computer products is managed, maintained and dynamically updated as product information changes. It has become a de facto standard for representing computer products among computer manufacturers, distributors and retailers. CNet Channel has used this expertise to collaborate with Edmunds.com to create a similar standardized approach to representing automotive products. In other words, the CNet Channel utility now has a degree of specialization in developing shared meaning that it is offering to other industries.

Integrators & Aggregators: Who's Running the Grid?

Somebody needs to knit together these enabling services into appropriate bundles, either by offering integration services or by aggregating enabling services into market- or company-specific service grids. In some cases, large enterprises with deep internal capabilities may perform this integration themselves. Other service grids will be self-organizing. And in other cases, service integrators will create highly specialized service grids tailored to the needs of individual large enterprises. Service aggregators will have a somewhat broader focus, creating service grids for specific

market segments such as insurance companies or managers of supply chains – the equivalent of the Society for Worldwide Interbank Financial Telecommunications (SWIFT) in financial services or Commerce One in supplier management.

As with the utilities providers, the early candidates for these roles are typically companies that began with a different business model, but have developed many of the enabling service capabilities and business relationships required in a service grid. Much of the early activity is concentrated in the first generation of electronic marketplace and business-to-business startups.

E2open: still open!

In September 2002, a consortium of high-tech companies led by IBM formed E2open to develop and operate a platform for collaboration with business partners in areas such as product development, supply chain management and procurement. E2open's technology/business platform provides a robust set of enabling services including directory services, security, data conversion and transaction-monitoring.

Greg Clark, E2open's new president and ceo, was formerly an IBM Distinguished Engineer and vp of Tivoli Systems, with a deep expertise in security architectures. He observes, "Our customers are grappling with the complexity of process integration across enterprises. The problem is especially acute in multi-party processes, such as vendor-managed inventory. We alleviate the complexity by offering network based services that integrate an any-to-any process synchronization platform with collaborative applications." E2open has invested serious money – $200 million – to create its robust network for process collaboration, using Web services technology to facilitate access to its enabling services.

E2open supports the exchange of XML documents using the Web services-based RosettaNet Implementation Framework and it is one of the first companies to introduce a commercial implementation of UDDI directory services. Its directory service, available only to E2open's customers and their trading partners, helps trading partners identify and connect to application services within their private trading networks. According to Clark, "E2open has developed a UDDI-based directory to capture and communicate business partner information and business process definitions. By maintaining this metadata in our directory, we shield our customers from change

E2OPEN INFO

Headquarters: Redwood City, CA
Founded: September 2000
Employees: 200
Funding: $200 million from Crosspoint, Morgan Stanley Dean Witter, and electronics companies including IBM, Lucent, Matsushita Electronic (Panasonic), Nortel Networks, Seagate , Solectron, Sharp
URL: www.e2open.com

management problems that occur when their partners migrate to new systems, data formats and protocols."

Its primary customers (which include founders IBM, Seagate Technology and Solectron) are six electronics industry "hubs" that collaborate with their partners and suppliers through the E2open platform on both a server-to-server and Web user interface basis. One of its customers – a contract manufacturer – processes 700,000 transactions with 400 suppliers monthly through the E2open platform. Its six hub customers network together a total of 1,000 suppliers.

The company operates on a software-licensing model, charging its customers a one-time activation fee and an annual software production license fee to allow the hub to execute transactions through its software. After a tougher-than-expected startup phase, Clark expects the company to turn cash-flow-positive next year.

Comergent: the sales grid

Comergent is another early contender for a service grid aggregator role focused on one broad market segment: B2B sales-channel management. Founded in 1998, Comergent began by recognizing that B2B sell-side processes can become quite complex, involving multiple channel partners to support the sales. The founders became interested in Web services as a cost-effective way to handle these complex interactions for its large enterprise customers, including DuPont, Maytag, Goodyear, Cisco and Nissan.

Comergent offers a variety of platform-independent Web services, including data transformation and messaging, in addition to its broader suite of partner-relationship management applications. It operates under a software-licensing model with software installed at its customers. "Because we built our software based on Web services, Comergent is able to ease the complex process of multi-channel sales with partners by automating interactions," says Bill York, cto and co-founder of Comergent. "We also provide the Comergent Network, a services transaction hub which facilitates connections between our clients and their selling partners to perform these transactions."

Comergent is led by Jean Kovacs, who also was a founder of Qualix Group (subsequently acquired by Legato Systems), a company that

COMERGENT INFO

Headquarters: Redwood City, CA
Founded: June 1998
Employees: ~100
Funding: $54 million from Amerindo, Ariba, Cisco, Crosspoint, Morgan Stanley, Mobius, Palantir Associates, Pivotal Asset Management, Van Wagoner Capital Management
URL: www.comergent.com

focuses on high-availability software. Before co-founding Comergent, cto York spent five years with Xerox PARC and Inxight Software.

Talaris: one-stop grid

Talaris Corporation, based in San Mateo, CA, represents another interesting candidate as service grid aggregator. Like E2open and Comergent, it is delivering important service grid functionality as part of a broader application service. Talaris helps enterprises manage the spend for employee service procurement – such as travel, package delivery and conference call services. Talaris was founded in 1999, spending its first couple of years building out a robust infrastructure using Web services technology to integrate thousands of service suppliers, ranging from Federal Express and American Airlines to local courier and car services. Just starting to market its service platform this year, Talaris currently has 120,000 suppliers of business services, including software functionality, accessible through its network.

The challenge Talaris faced was not only the diversity of suppliers, but also the complexity of the transactions. Imagine a typical travel itinerary including airlines, hotels, car rental services, restaurant reservations, and their various interdependencies. Talaris has deployed an innovative set of service grid utilities to manage this complexity, including shared message queues, automated fail-over facilities, monitoring and reporting services, a rules-based workflow engine and enhanced registries that go well beyond basic UDDI information.

TALARIS INFO

Headquarters: San Mateo, CA
Founded: June 1999
Employees: 50
Funding: $25million from Charter Ventures, Jafco, private individuals
URL: www.talaris.com

To facilitate automated interactions among its customers and service providers, Talaris has defined an XML-based Services Business Language to create a standardized way of representing services (standardized for its clients, at least!).

Patrick Grady, ceo and co-founder of Talaris, says "Service grids are critical to supporting Web services-based connections across enterprises. When we started three years ago, we had no choice but to develop many of these utilities on our own – there weren't a lot of options in the market. Over time, we will look for, and plug in, specialized third party utilities to enhance the performance of our application services. We'll also explore opportunities to make some of our utilities available to others. We want to remain a service grid aggregator, assembling the right utilities for Web services users in our target markets."

While Talaris markets its application services to enterprises through a direct sales force, Grady anticipates that there will be an opportunity for others – carriers, portals and telematics vendors – to take advantage of Talaris' service grid and related applications to build "meta-services" for other customers. In other words, he envisions a true service grid, where unrelated parties can easily pick and choose the services they need, and can rely on the service grid for the technical and business infrastructure to make it all seamless.

Old collaboration wine in new service grid bottle

Other candidates for enabling service aggregators include existing industry collaboration hubs, such as Sabre in the travel industry and SWIFT in the financial services arena. Both of these companies are implementing Web services interfaces to their existing service offerings to reduce integration costs for their customers.

Sabre has been very aggressive in deploying Web services front-ends and back-ends to its core reservation service. On the front end, for example, it introduced in 2001 an XML Power Tool Kit, middleware that helps developers write applications for Sabre's powerful Global Distribution System (GDS) without mastering its proprietary interfaces. The GDS is a secure, high-volume transaction-processing engine that provides back-office support to a broad range of travel companies. As a sign of its broad support of Web services technology, Sabre was one of just five non-technology providers, including DaimlerChrysler, Ford Motor Company and United Airlines, to join the Web Services Interoperability Organization (WS-I) as a founding member. WS-I is a cross-industry initiative designed to ensure that evolving Web services standards foster interoperability across technology platforms.

SWIFT is a candidate to provide specialized service grid capabilities for the financial services industry. It is one of the premier messaging platforms specialized in serving more than 7,000 financial institutions in 197 countries, with revenues of $500 million in 2002. Its platform has been optimized for highly reliable and secure financial messaging services. SWIFT is migrating its customers from its traditional X.25-based network to SWIFTNet, an IP-based messaging platform and secure network. As part of this transition, SWIFT has collaborated with Cape Clear and other technology companies to expose its messaging service and related applications, such as cash reporting as Web services, significantly reducing users' integration costs. The banks will be able to offer valuable payment processing services to their corporate customers, leveraging the functionality of the SWIFT network in the process.

Cio Joe Eng says, " SWIFTNet is a form of a service grid in that SWIFT facilitates business flows with XML technology to help counterparties not just communicate with each other from a technical perspective, but also from a business logic perspective. The enabling services available from SWIFTNet in terms of security and other operational capabilities help to make Web services technology more relevant to mission-critical connections among financial institutions." Ceo Leonard Schrank anticipates a growing commitment to Web services technology: "SWIFTNet meets Web services at our SWIFTNet Link (SNL) software interface which we mandate for every SWIFT user. There would be a real benefit for SNL to evolve over time to be more compliant with Web services standards."

In both the Sabre and SWIFT cases, the primary focus of Web services implementation has been to expand the reach of a vendor's robust messaging and transaction-processing networks by making it easier for customers to connect. Both industry hubs also have an opportunity to add more value to their networks by using Web services to add functionality in areas such as data conversion and reputation sources. Their willingness to access this functionality from specialized third party enabling services rather than trying to develop it internally will be one of the real tests as to whether they eventually evolve into true service grids.

From sole source to aggregator

Finally, existing providers of network services could become service aggregators. In the grid computing space, companies including Avaki Corporation and initiatives such as the Legion project at the University of Virginia are offering early forms of service grids that aggregate enabling services including fine-grained security services, policy-based configuration and administration of resources, and automatic failure detection and recovery (SEE **RELEASE 1.0**, NOVEMBER 2002).

For the few survivors of the first generation of application service providers (ASP) and broader providers of network services, the service grid solves one of their fundamental challenges: They had to develop from scratch an entire set of enabling services to support their application offerings. These application offerings frequently had substantial limitations (SEE JOHN HAGEL'S RECENT BOOK, **OUT OF THE BOX**, LISTED IN RESOURCES SECTION), but their enabling services represent an important foundation for a potential service grid offering.

Providers of network services such as AT&T and Verizon could also play the role of service grid aggregator by leveraging their customer relationships and expertise in operating scalable and reliable network services. These companies typically have fewer enabling services of their own to offer, but could become attractive packagers and resellers of more specialized enabling services, especially from newer companies lacking brand recognition or operating track record.

British Telecom in September 2002 indicated its interest in the service grid opportunity when it announced a "business class" environment for the delivery and management of Web services-based solutions. Designating its offering as the Web Services Management Layer (WSML), BT indicated it would provide a broad range of functionality, including security, non-repudiation, SLA monitoring, usage metering and billing to support both providers and consumers of Web services. Available in January 2003, the WSML is essentially a hybrid platform, consisting of a Web-based central network management system and proxy servers. To deliver this capability, British Telecom will be partnering with both Microsoft and Flamenco Networks (PAGE 23), a much smaller and more focused Web services management start-up.

Big business. . .

Let's also not forget the role of the large enterprise as a spawning ground for enabling-service aggregators. Many larger companies such as General Motors, Dell and Merrill Lynch are rapidly deploying Web services technology within their own enterprises and with business partners. In many cases, they are creating enabling service capability internally and drawing upon more specialized third-party utilities to knit together their own internal service grids. Over time, they may see an opportunity to offer other companies access to these service grids. This will likely happen first for their close business partners, but they may eventually seek to generate additional revenue by spinning out these service-grid aggregation platforms as distinct businesses available to a broader range of customers.

John McKinley, the cto of Merrill Lynch, has become a vocal champion of the business benefits of Web services technology. As an early adopter, he has a realistic view of both the need for, and the opportunity created by, service grids: "While organizations are beginning to harvest early stage returns on their Web services initiatives, we are well short of the required infrastructures and standards required to realize the full potential of the technology. More intelligence needs to reside 'in the cloud' on two fronts. At a technical level, it's issues of transaction integrity, security, quality of service measurement and alerting. At a business level, it's being able to avail our-

selves of things like data normalization/translation services and shared billing and payment infrastructures."

Perhaps the most interesting early example of this potential General Motors' deployment of the OnStar wireless portal into the automobile and its ambitions to offer a broad range of services over that network to its more than 2 million subscribers (SEE **RELEASE 1.0**, MARCH 2002). Like many of the examples described above, OnStar is a hybrid platform, combining both application functionality and enabling services. Tony Scott, the General Motors cto, highlights the potential that GM sees in the service grid concept, especially as it applies to the automotive industry: "Clearly, software based service represents a huge opportunity in the automotive space. The ability to weave together a fabric of service – to create a service grid, if you will – will make some companies leaders, both in terms of operating efficiencies and in the marketplace as a whole."

While many of these enabling services are provided by GM itself, others are delivered by specialized utilities like MagnetPoint. Based in Novato, CA, MagnetPoint started in 1999 as a communications software company focused on mobile applications. It began with a self-contained software package but has opened up its technology with Web services to become more of an environment for building applications.

MagnetPoint has developed a strong niche providing a hosted testing environment for Web services delivered over wireless networks, including new services to be delivered over OnStar. This service grid utility helps providers of Web services accurately assess the performance of their services within various mobile networking environments. MagnetPoint has also developed a platform to enhance the value of UDDI directories, connecting users in mobile networks with the most appropriate application services. . .call it roaming UDDI.

. . .and small businesses, too.

In the field of start-ups, a broad range of companies has emerged over the past several years focused on addressing the need for robust management platforms for Web services. Actional, AmberPoint, Talking Blocks, Infravio, Blue Titan, Confluent, Digital Evolution and Primordial are all staking out territory in key areas such as messaging, security, transformation, monitoring and quality-of-service management. However, all of these companies are focused on delivering management functionality as licensed software installed within the enterprise and managing Web

services behind the firewall. Thus, they have little to offer currently in terms of service grid capability.

Nevertheless, as competition intensifies (and especially as the major application server vendors begin to expand their Web services management capability), these companies may start to look beyond the firewall. To the extent that they can move quickly enough, they may be able to carve out positions as service grid aggregators or, with more narrow functionality, as service grid utilities. They will have two challenges if they seek to pursue such a path: Operating a managed service business is very different from a packaged software business, and coordinating activities across enterprises involves far more complexity than coordinating activities within enterprises. These are the same challenges that face any of the major application server vendors (e.g., IBM, BEA, Sun, Microsoft and Oracle) if they decide to enter the service grid business. But they, of course, have more resources to apply against these challenges.

Grand Central: all agrid!

Coming from the other direction is service grid start-up Grand Central Communications (SEE **RELEASE 1.0**, DECEMBER 2000, OCTOBER 2001 AND MARCH 2002), which launched its service last year. Unlike the companies mentioned above, Grand Central started with the explicit objective of providing enabling services to support connections across enterprises. (DISCLOSURE: BOTH JOHN HAGEL AND JOHN SEELY BROWN SIT ON THE BOARD OF ADVISORS, AND HAGEL IS ALSO AN INVESTOR.) It describes itself as a Web services network, supporting inter-enterprise connections with security, messaging, orchestration and monitoring, delivered as a subscription service. Grand Central offers a bundle of related enabling services, rather than simply one isolated service.

One of its clients is Xilinx, a supplier of programmable logic circuits. Xilinx relies on IBM Microelectronics as a strategic foundry to produce many of its designs. When IBM shifted from FTP to HTTPS as a core standard for transmitting its quality-test data, Xilinx turned to Grand Central. Grand Central took SOAP messages over HTTPS from IBM foundries and converted them into FTP messages on a virtual private network to be accessed by Xilinx. Xilinx says that working with Grand Central cut the cost of adapting to this shift in standards by 90 percent, while at the same time creating more flexibility to handle additional standards used by other business partners. "Xilinx connected to Grand Central's Web services network in less than one day, making this one of our quickest and easiest IT integration projects ever," says Sheri Anderson, cio of Xilinx.

Grand Central is starting to extend its own range of services by signing up more specialized utilities such as VeriSign and Contivo. Lining up $28 million in second-stage financing earlier this year, Grand Central has gained early traction with customers such as Eastman Chemical, Xilinx and Wachovia. Ceo Craig Donato says, "Our Web Service Network is a service grid that meets a growing need in the Web services arena: It removes complexity from the end-points and compresses the time required to deliver real business value from business initiatives across enterprises. Our service will help to accelerate adoption of Web services by reducing the hurdle to deployment."

GRAND CENTRAL INFO

Headquarters: San Francisco, CA
Founded: May 2000
Employees: 50
Funding: $30 million from Benchmark Capital, Court Square Ventures, Eastman Chemical, Cargill
URL: www.grandcentral.com

In reflecting on the challenges ahead for Web services deployment, Donato observes "Most people still significantly under-estimate the complexity of operational and technical issues that need to be coordinated. It's not just a technology issue. It often becomes a power struggle: 'Whose technology is better, yours or mine?' Service grids are essential to mediate this complexity and defuse the tensions. They enable corporations to deploy the technology at their own pace without having to wait for their slowest partners to come up to speed. Our customers like Wachovia and Xilinx cite this as a key benefit of our Web Services Network – a service grid platform."

Flamenco: away from the center

Another start-up contender is Flamenco Networks (SEE **RELEASE 1.0**, OCTOBER 2001), which introduced its Flamenco Network in late September 2001 and completed a second round of $7.4 million in funding in mid-2002. Based at the other end of the country from Grand Central in Alpharetta, GA, Flamenco also has a different perspective on the best way to deliver service grid functionality. It pursues a more decentralized approach: Web services messages are sent directly between requestor and provider, through a lightweight proxy that resides at each (customer) network end-point. This proxy caches, monitors and manages SOAP messages. The proxies are in regular communication with Flamenco's central servers that perform a variety of service grid functions, including operation of a centralized registry, non-repudiation functionality and service level monitoring.

FLAMENCO NETWORKS INFO

Headquarters: Alpharetta, GA
Founded: August 2000
Employees: 25
Customers: 10
Funding: $14.5m from Flagship Ventures, Noro-Moseley Partners, Cordova Ventures
URL: www.flamenconetworks.com

Businesses can sign on to Flamenco Network directly as a managed service. Alternatively, as with its relationship with British Telecom mentioned above, Flamenco can leverage the capability of a well-established partner to offer service grid functionality to a broader

range of network users. John Hanger, svp of sales and marketing outlines the rationale for the relationship: "To be a provider of service grids, you need two critical ingredients: technology and trust. British Telecom, like many established service providers, has trust relationships with thousands of existing corporate customers."

All-in-one

So far, we have focused on service grid aggregation – creating service grids designed to meet the needs of broad segments of the market. There are also early initiatives to provide service grid integration – knitting together enabling services to meet the needs of an individual customer.

Of all the traditional systems integrators, IBM Global Services has shown the most interest in playing the role of service grid integrator. Professional service firms such as Accenture are also candidates for this role, though to date they have remained much more focused on conventional systems-integration businesses.

IBM's announcement of its "On Demand Business" strategy certainly signals an increasing interest in the delivery of utility computing services. Much of the initial publicity focused on applications delivered as services to small and medium enterprises as well as on utility computing infrastructures. For this vision to become a reality, a rich set of enabling services must be knit together to support connections across enterprises.

The continuing focus of the large systems integration players on their traditional business (especially large-scale ERP implementations) leaves an opening for smaller, more focused integration firms to enter the fray. NerveWire is a particularly promising candidate in this category. A professional services firm based in Newton, MA, NerveWire describes itself as a "collaborative commerce integrator."

NERVEWIRE INFO

Headquarters: Newton, MA
Founded: October 1999
Employees: 150
Funding: $ $60 million from Thomas Cressey Equity Partners
URL: www.nervewire.com

Despite that grand label, NerveWire has remained tightly focused on helping companies in financial services, high technology and manufacturing connect more effectively with their business partners using electronic networks. This tight focus helps explain why NerveWire has managed to grow profitably while other consulting firms have fallen by the wayside.

NerveWire combines business strategy development with deep expertise in technology implementation, drawing on a group of

experienced technology architects with backgrounds from Computer Sciences Corporation, Accenture and Cambridge Technology Partners. Kirk Arnold, the ceo of NerveWire, has over 20 years of experience in the consulting and high-tech industries, including serving as president of CSC's Consulting Group.

Since it is focused on establishing technology connections across enterprises, NerveWire will need to help clients integrate appropriate enabling services to support deployments of Web services technology across enterprises. Firms like NerveWire can help clients not only to integrate service grids, but also advise them on specific utilities that can deliver "best of breed" functionality. Its clients include J.P. Morgan, Merrill Lynch, Morgan Stanley, State Street Corporation, Hewlett Packard, Nokia, Philips, DuPont and Novartis.

Arnold describes the need and the opportunity: "We help companies to connect with each other more effectively using technology. Web services will play a major role in enabling these connections, but service grids will be essential to provide mission critical functionality. One of our major opportunities is to help clients assemble the appropriate service grid for their specific needs."

Service Grids: Can't Live Without 'em

Yellow pages from the grid

Service grids are a prerequisite for the economic impact and success of Web services. In fact, they have the power to accelerate the adoption of Web services technology by removing obstacles, including a lack (or invisibility) of key technology and limited implementation skills.

As discussed earlier, service grids provide key functionality that supports mission-critical Web service applications and enables revenue generation from Web services by offering billing, metering and monitoring service. They can also ease the task of finding appropriate Web services.

As indicated above, UDDI and WSDL are useful standards for directory services, but a service grid can develop, manage and refine the actual information required to discover and evaluate the exploding array of Web services options. Presumably, customers will ultimately perform quality control by selecting specific directories to rely

on, and those directories, just like the yellow pages of old or Yahoo and Google today, will play a key industry role that may make other players nervous.

Four companies to date – IBM, Microsoft, SAP and NTT – have signed on as registry node operators of the Universal Business Registry service, a publicly available UDDI-based directory service, jointly run by these four companies under the name UDDI Operators Council. This registry lists over 7,000 publicly available Web services, but it has thus far attracted limited use for two reasons. First, early Web services implementations are mostly within private networks of business partners, reducing the utility of public listings. Second, companies are discovering that the current level of information available through public UDDI listings is often inadequate, especially to determine the appropriateness of specific Web services for particular application environments. The information is often incomplete, even for the attributes currently captured. In other cases, users may want to access additional information – for example, assurances from a third party that the services actually perform as represented. That's why we need the service grid!

Removing roadblocks on the speedway

Service grids do more than just enable Web service applications. They reduce the complexity of implementing Web service applications by mediating among technical standards and conflicting business policies across enterprises. This reduction in complexity can accelerate the adoption of Web services technology, particularly among smaller companies with shallow pockets and smaller divisions of large enterprises. As a result, the development, maintenance and enhancement of specialized new services can be amortized across many companies.

By taking much of the functionality that would otherwise be installed in the end-point devices and delivering it as a set of managed enabling services, service grids make it much simpler for end-points to connect. They take the escalating complexity confronted by any one end-point as it seeks to establish many-to-many connections for customers across a broad range of other end-points, and move that complexity into shared utilities that have deeper capability to handle it.

Service grids also reduce complexity by mediating among contending standards. While technologies already exist to address such important business issues as security, business process management and management of extended transactions (such as booking multi-provider travel reservations or clearing security trades that involve a set of hedges), it is not yet clear which of these – or their Web service implementa-

tions – will become the technologies of choice. Even the foundation standards (XML, SOAP, WSDL and UDDI) are evolving as companies propose enhancements to make them more robust. Specialized translation/transformation modules in service grids can help to translate and hide some of the proliferating standards.

Application frameworks create a broader mediation challenge. For example, the ability to consume a Web service developed on the IBM WebSphere platform will be governed by an access control list service available within the WebSphere application framework but not seamlessly and transparently recognized within BEA's WebLogic framework. Service grids can help by creating a meta-framework to mediate these differences.

Learning in hyperspeed

By encouraging specialization and helping specialized utilities to reach a broader set of users, service grids accelerate learning and performance improvement. Each specialized utility is able to focus resources on its distinctive area of competence and attract and retain the best talent in that area. In contrast, when more diversified companies seek to offer these enabling services as a secondary business, the companies often treat the talent required to develop and improve these services as second-class citizens.

Specialization and reach provides an even more powerful engine for learning and performance improvement. This is a specific benefit worth emphasizing: Shared operational data gives you insights you could not get as an individual player. These enabling service utilities typically operate in a much broader range of environments and see a much broader range of events than "captive" service utilities that support the operations of one company or segment of the market. As a result, they gain more experience more quickly and can learn from that experience to refine their own service offerings to become even more effective. This learning effect can be particularly critical in areas such as intrusion or attack detection in security services or shared meaning and data conversion services, where the ability to see many situations or contexts provides a unique advantage. Understanding market pricing is another example.

The Future of Service Grids

While the emergence and evolution of service grids and their constituent enabling service utilities are still at the earliest stage, we can speculate about possible paths they will take by looking at current forces and tensions. These forces will play out on three levels – customer behavior, functional similarity and economics. Of course, these three levels are not independent, but interact with each other in subtle and unpredictable ways. We invite readers to imagine the future and then to invent it.

One-stop shopping for the best

Business customers tend to fall into one of two camps: what we term sophisticated "piece-parters" vs. convenience-driven, less cost-sensitive one-stop-shoppers. The piece-parters invest to create deep internal expertise in the integration of technology platforms because they don't want to compromise in sourcing best-in-class technology products. Typically, these companies operate in technology-intensive industries such as financial services; they generally compete by continuously innovating technology-enabled business design.

Most companies, however, tend to be convenience-driven one-stop-shoppers. This segment has driven much of the growth of the enterprise application market over the past decade: They would rather source a full suite of capabilities from one vendor, even if it means sacrificing the ability to use best-in-class products.

Service grids represent an interesting opportunity to address the needs of both segments. Sophisticated piece-parters may be more willing to do business with enabling service aggregators or, more probably, enabling service integrators because they would still have access to the best-in-class service grid utilities and the functions behind them.

Convenience-driven one-stop-shoppers may also rely on enabling service aggregators because they would still enjoy the convenience of one-stop-shopping while gaining access to a broader range of best-in-class service grid utilities.

Conjunction of functions

Some of the enabling services of service grids are closely related to each other, both in terms of functionality and skill. For example, monitoring of Web services is likely to be closely related to the metering of usage required for billing. In this case, it is

likely that the same business that offers monitoring capability will eventually offer metering services as well. On the other hand, the billing for service requires such a different set of functionality and skill from either monitoring or metering that it is likely to be provided by a separate business.

It is this kind of functional bundling logic that led us to differentiate four different categories of utilities in the service grid (SEE FIGURE 1 PAGE 9). Broadly speaking, the services in each of these categories share enough similarities that it may make sense for bundled service providers to emerge within the category. The shared utilities category is the one exception to this – these are set apart because they are so different from the other enabling services and yet they do not share much similarity in terms of functionality or skills with each other.

These four categories can be helpful to businesses considering developing and/or offering specialized enabling services as utilities. One of the key issues facing executives in these businesses will be their ability to expand over time into adjacent specialized services.

Serving the services

Enabling services may benefit from shared economies in technology development, services operation or customer acquisition and management. These shared economies may in turn drive decisions to merge with related utilities or to outsource certain activities to even more specialized providers.

For example, the operation of the facilities required to deliver enabling services as part of a service grid may be much more efficient if the facilities are shared across a range of enabling services rather than dedicated to a single enabling service provider. In this case, facilities management companies may become an attractive outsourcing option for service grid utilities.

In another example, the various enabling services grouped in the service management utility category are likely to be selling to the same decision-maker. There may be an economic advantage for all of these enabling services to be marketed and sold through a common sales force. This may drive a tendency towards consolidation within this category of enabling services.

Opportunities and implications

We are likely to see service grid business structures evolve through three broad waves of development, starting with bundling, then going through a fragmentation phase and ultimately culminating in a different form of bundling.

The very nature of Web services and service grids may make industry consolidation *appear* less inevitable than it has been in, say, the PC, mainframe or enterprise software industry. However, that's a short-sighted view.

Initially, entrants into this business are likely to face strong pressure from risk-averse and confusion-averse customers to bundle their offerings together (explaining at least to some degree choices made by early players like E2open, Comergent and Grand Central). So companies looking to get some early traction in this arena better have some deep pockets – a situation which perhaps favors more established companies such as Sabre and SWIFT.

Later, while there will likely be a process of unbundling and fragmentation in the medium term, there are also some interesting consolidation plays over time within the four categories of utilities, with particular rewards among certain sweet spots (listed below). This addresses the investor concern of, "Why should I invest a lot of money to play in this arena if the outcome is a bunch of small but profitable niche businesses?" We believe that many of these businesses will in fact become quite large and highly consolidated, at least within the four utility categories.

And finally, if the service grid market properly reflects its peer-to-peer nature, we may see the emergence of consolidated players from the bottom up. Rather than companies founded by entrepreneurs and fueled by VCs, a group of industry players could draw ever tighter, first defined by common rules and contracts and business policies through a service grid, and eventually merging to form a single entity. Structurally, that sounds plausible; politically and socially, it may be a stretch. But we'll be on the lookout for such developments.

Sweet spots on the grid

- **Third party auditing/reputation engines:** Customers will want assurance that Web services and Web service providers (especially if they are not close business partners) are both reliable and trustworthy. They are likely to turn to independent third-party auditing and rating services. These auditing services are likely

to become highly concentrated and profitable, much like credit rating and bond rating services. Dispute resolution services like SquareTrade (SEE **RELEASE 1.0**, OCTOBER 2000 AND MARCH 2001) may also create highly profitable franchises by developing the expertise required to resolve disputes quickly and efficiently, with standards for the proper remedies for specific kinds of damages. Reputation engines are also likely to emerge, providing a platform for users to rate the performance of Web services and their providers. Like eBay's reputation service, successful reputation engines have strong increasing-returns economics: Once a critical mass of users begins to rely on a particular reputation engine, it will tend to crowd out smaller competitors.

- **Business policy repositories and interpreters:** There is both opportunity and challenge in providing mediation of business policies across enterprises. The first requirement is to create repositories that capture and represent business policies and contracts in standard, explicit terms. But that is only the beginning. Specialized services that can mediate across different business policies, find points of agreement and reconcile the differences will be particularly valued. These businesses will become highly concentrated and profitable because of the proprietary expertise that a large-scale player can develop.

- **Collaboration hubs:** As we have indicated above, collaboration hubs are likely to emerge within particular industry or market segments, offering deep vertical or business-process expertise to help companies operating in the same arena to more effectively collaborate, such as apparel design and production or real estate management. Once again, specialized vertical or business-process expertise will drive the tendency towards profitability and concentration. This expertise will become more refined as early providers of this capability gain a critical mass of customers within the target segment, making it harder and harder for smaller and newer entrants to compete effectively. Of course, small, niche specialists will still have room to succeed along with big consolidators.

Implications for technology vendors

At a minimum, technology vendors can play the role of evangelist and facilitator for early service grid utilities and service aggregators. They can educate their customers regarding the role and importance of the service grid. Vendors can also invest in certifying the capabilities of the early service grid providers and help to introduce them to their customers.

More broadly, it is possible that service grids over time will "hollow out" the functionality of existing technology frameworks and platforms such as application servers and EAI middleware platforms. BEAware! Of course, those same server and middleware vendors have the opportunity to transform their business models to benefit from Web services. . . .

At a minimum, emerging service grid capabilities are likely to lead to a commoditization of enterprise-centric technology platforms, ranging from computing hardware to massive enterprise applications. To date, the difficulty of connecting these platforms has helped to protect those platform vendors who have built up a substantial installed base. With the ability to establish robust connections across diverse technology platforms, the logic for sourcing from one vendor erodes significantly. Vendors may find it easier to get big by having lots of customers rather than big customers.

COMING SOON

- Digital identity for objects.
- Social software.
- Human capital.

- And much more. . . (If you know of any good examples of the categories listed above, please let us know.)

Implications for customers

Customers can do more than monitor and adapt. They can also influence and shape the deployment of service grid capabilities. Cios need to become active evangelists for service grids, lobbying with their primary Web services technology vendors to increase their sense of urgency regarding service grid development. They can also encourage the development of new service grid utilities, aggregators and integrators as early adopters of these services and as providers of constructive feedback.

Finally, enterprises can play a role by exposing their own existing capabilities, initially to their own partners and then to a broader market, as Citibank did. Those with the requisite resources can also invest in the creation of new enabling services turning cost centers into profit centers. Not a bad outcome!

Note: We would like to acknowledge the help of independent consultants and technology architects Martin Milani and Ken West in the discussions that shaped the perspectives in this article.

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Stratton Sclavos, **VeriSign**, 1 (650) 961-7500; fax 1 (650) 961-7300; stratton@verisign.com

For further reading:

John Hagel, **Out of the Box: Strategies for Achieving Profits Today and Growth Tomorrow through Web Services** (Harvard Business School Press, 2002)

John Hagel, **Net Worth: Shaping Markets When Customers Make the Rules** (Harvard Business School Press, 1999)

John Hagel, **Net Gain: Expanding Markets through Virtual Communities** (Harvard Business School Press, 1997)

John Seely Brown, **The Social Life of Information**, (Harvard Business School Press, 2000)

Calendar of High-Tech Events

2003

JANUARY 9-12	**International CES** – Las Vegas, NV. The world's largest consumer technology tradeshow. If you're a gadget-head, this is paradise. For more information visit the Website or call 1 (866) 233-7968, 1 (301) 631-3983 (outside US); fax, 1 (703) 907-7601; CESinfo@CE.org. www.cesweb.org
JANUARY 21-24	**LinuxWorld Conference & Expo** – New York, NY. This place to be for anyone interested in Linux and other open-source technologies. Visit the website or call 1 (800) 657-1474. www.linuxworldexpo.com
FEBRUARY 4-6	**Milia** – Cannes, France. The place to check out everything to do with interactive entertainment. Come play! (And make deals and spot trends, of course.) For more information contact Laurine Garaude, laurine.garaude@reedmidem.com; +33 (1) 41 90 46 30; fax, +33 (1) 41 90 44 70. www.milia.com
FEBRUARY 16-18	**Demo 2003** – Phoenix, AZ. Come play with the latest gadgets from the newest startups. Register online or contact Lavayne Harris at 1 (800) 633-4312 or 1 (650) 577-2700 (outside the US), or via email at registrar@idgexecforums.com. www.idgexecforums.com/demo/
FEBRUARY 17-21	**3GSM World Congress** – Cannes, France. The world's biggest mobile communications show. Featuring Esther Dyson as a keynote speaker. Register online or contact Tamara James, 44 (1932) 893-853; fax, 44 (1932) 893-894 ; 3gsm@informa.com; www.3gsmworldcongress.com **E**
FEBRUARY 24- MARCH 1	**TED2003: "Rebirth"** – Monterey, CA. This will be the first TED not run by Richard Saul Wurman, but the new organizers promise the same experience: "Electricity for the Brain... Tools for the Mind... Food for the Soul." Contact Chris Anderson, 1 (650) 851-6464; fax, 1 (650) 851-9172; chris@ted.com. www.ted.com/
MARCH 7-11	**SXSW Interactive** – Austin, TX. In its tenth year, this offshoot of the South-by-Southwest independent film festival draws cutting-edge new media developers and content creators. Register online, or for more information call 1 (512) 467-7979; fax, 1 (512) 451-0754; email, inter@sxsw.com. sxsw.com/interactive/
MARCH 23-25	**PC Forum** – Scottsdale, AZ. EDventure's premier conference...25 years and running! Our theme this year is "Who? What? Where? Data comes alive." Confirmed speakers include Larry Ellison (Oracle), Jonathan Miller (America Online), John McKinley (Merrill Lynch) and Kevin Turner (Sam's Club/Wal-Mart). Registration is now open on our Website. For more information contact Daphne Kis, 1 (212) 924-8800; fax, 1 (212) 924-0240; email daphne@edventure.com. www.edventure.com/pcforum/ **E** **D**

E Events Esther plans to attend.
D Events Daphne plans to attend.

Lack of a symbol is no indication of lack of merit. The full, current calendar is available on our Website, www.edventure.com. Please contact Christina Koukkos (christina@edventure.com) to let us know about other events we should include.

The Fairmont Scottsdale Princess
Scottsdale, Arizona
March 23 to 25, 2003

Who? What? Where? Data Comes Alive.

The theme for this year's PC Forum is focused on the basic questions that drive IT investment: Who? What? Where? Customers use IT in a huge range of ways, but in the end it all comes down to managing data about the world at large in order to generate efficiencies, serve customers and develop new business opportunities.

Establish business partnerships * Leverage information * Find young companies

General sessions feature lively discussions among the speakers and attendees in an open, interactive format. For our breakout sessions, we have invited a group of stubbornly optimistic entrepreneurs to debut their young companies and innovative technologies.

Other sessions will feature small, focused workshops that drill down on key technology concepts and markets. These sessions will be moderated by experts in the field and showcase a number of early-stage companies. They will cover subjects such as **digital identity of objects** (including taxonomies and data standards), **personal identity management**, compelling **wireless applications**, **mapping & location-based services** and **open source software**.

Confirmed speakers include:

Marc Benioff, *Chairman & CEO*, Salesforce.com
Larry Brilliant, *CEO*, Cometa Networks
Sergey Brin, *President, Technology & Co-founder*, Google
Robert Carter, *CEO*, Fedex Services *& EVP & CIO*, FedEx
Mark Cattini, *President & CEO*, MapInfo
Lawrence Ellison, *Chairman & CEO*, Oracle
Gordon Eubanks, Jr., *President & CEO*, Oblix
Jerry Hale, *VP, CIO*, Eastman Chemical
Jeff Jonas, *Chief Scientist & Founder*, SRD
Henning Kagermann, *Co-chairman & CEO,* SAP
Gilman Louie, *CEO,* In-Q-Tel
Maria Martinez, *President & CEO*, Embrace Networks
Bill McGlashan, *Chairman & CEO*, Critical Path
John McKinley, *EVP & Head of Global Technology & Services*, Merrill Lynch
Jonathan Miller, *Chairman & CEO*, America Online
Craig Mundie, *CTO, Advanced Strategies and Policy*, Microsoft
Paul Otellini, *President & COO*, Intel
Jonathan Schwartz, *EVP, Software*, Sun Microsystems
Kevin Turner, *CEO*, Sam's Club/Wal-Mart

To register and for speaker updates, please visit

http://www.edventure.com/pcforum/

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